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are left as a corpse. In many insects death accompanies reproduction; but in cases where the two phenomena are separated in time, Götte supposes such a separation to have been secondarily acquired. A corpse is a secondary affair and not a necessary adjunct to the process that produces the corpse, and which we ordinarily call death. The individual is not to be looked on alone as the sum of the activities of its constituent units, but rather as the *interrelations* which these units sustain. The same number of cells engaged in the same amount of physiological work may be so differently arranged in two cases as to constitute two very different individuals. *Death is the breaking up of the relations*, and the units may survive. Or, if as in the metazoa, many units depend for their life, on the integrity of the relations subsisting between the different parts of the whole, their organization, too, may be destroyed. Tissue death follows individual death as a secondary or accidental consequence.

We may illustrate Götte's idea by an analogy. Essentially, there is no difference in the idea of death as applied to biology, and as applied to the death of a literary society, when the members agree to disband, possibly to found new societies. If we could feel sure that the analogy is something more than a mere analogy, but at bottom is a universal principle of life, we could gain immensely by a mutual comparison between sociology and biology. There are many terms and ideas common to the two sciences, such as division of labor, development, atavism, colony, etc. Reproduction by self-division might be illustrated by the splitting of a tribe into two. Budding by the founding of a colony by emigration of individuals representing different trades needful in the new colony. Sexual reproduction by the emigration of a single couple, and the gradual development (embryology) of a colony, with the differentiation of labor, as the individuals increase in number. The individual in this illustration represents the gemmule. The integrity of the state does not depend on the number of persons, though the amount of its activity and wealth does. Similarly, in the cell, the gemmules may be of like nature and vary much in number. Here the illustration favors the view of Kölliker rather than of Weismann. Although the work of two persons may be different, they are essentially alike in characteristics, and the descendant of any person in a state, could found a similar state if forced to do so by emigration.

Ueber Leben und Tod. WEISMANN. Jena, 1883.

Götte's paper was attacked by Weismann as follows: First, there is no evidence favoring Götte's idea of rejuvenescence in the protozoa. Death can only ensue when cells no longer immortal are produced by ontogenetic development of the germ cells of metozoa. Nothing else deserves the name. Death accompanying reproduction is in all cases catastrophic and due to the strain. This sort of death cannot be inherited and so cannot be established by the action of natural selection. Development is the result of a peculiar method of reproduction (the sexual) that has been acquired because of its advantages. Death itself has been secondarily established as a further advantage. The species is still immortal so long as the germ cells are, and the soma or individual is a subordinate and temporary (cyclic) affair, constructed by the germ cells.

We have dwelt on these questions because the interrelation of reproductive cells and body is the most vital in every question concerning sex and sexual functions. Weismann's idea that the whole body stands over against the reproductive organs as the equivalent of one reproductive cell, seems to explain the fact that the extirpation of the reproductive organs, does not destroy the integrity of the individual, or cause death as happens, when for instance, the excretory organs (kidneys) are extirpated. Still, no sharp line can be drawn here, for some

organs like the spleen, can be extirpated without causing essentially different effects from those seen to follow castration. The presence of the reproductive organs, on the other hand, exerts a profound influence on the body. From the standpoint of Kölliker all the organs of the body are morphologically homodynamous while physiologically related as chief and subordinate groups.

In this connection we may briefly refer to another matter which has engaged the attention of morphologists, viz., the question of homologies. It is well known that in the segmented animals the organs of the body are (typically) repeated for each segment so that there is a certain independence in the segments. In many worms a detached segment or segments may reproduce the whole body, and similarly the detached segments are reproduced in the animal from which they were taken. The number of segments also is often indefinite and increases with age. There are animals with the segments alike and others where differentiation has taken place. In all these latter cases, the segments cannot reproduce themselves and their number is fixed. Just as there are cell groups that dissolve to allow each cell to enter upon its reproductive work so there are segmented forms, like the Hydroid *Strobila*, and the Tape-worm in which the segments become separated for reproductive purposes. In the embryology of segmented animals, the segments appear successively as in the *Strobila*. Now if we conclude that metamerism segmentation is of the nature of zooid reproduction by division (*strobilisation*) we can easily account for correlated variation, for the egg is the ancestor of a typical first zooid, which is ancestral to all the others, and any hereditary peculiarity of any part of this zooid must appear in all the other segments. If we adopt this view, can we apply the Weismann dictum? Which is the segment that remains undifferentiated and is the equivalent of all the others? Here again, Kölliker has the better of the argument. A study of the growth of *Chara* seems to point to a compromise between the two positions and also serves as a model to show how complicated a structure may be built up by the repetition of a single mode of division, of which the law in *Chara*, is: The continuous production, from an apical cell of cells that are each capable of division into two cells, one with the characteristics of the apical cell, the other (the internodal cell) with the powers of indefinite growth without division.

Article "Sex" Enc. Britannica; and Proceedings of the Royal Society of Edinburgh, 1886. GEDDES.

Geddes attempts an explanation of a division of this sort, by considering, that two sets of forces *Katabolic* (those that destroy protoplasm, liberate energy, and effect external work, resulting in cell multiplication) and *Anabolic* (those that build up protoplasm, absorb energy, and effect internal work, or growth) are in a certain balance in life; and there is an alternation between the ascendancy of the two sets of forces. An *ovum* is a cell in which anabolism is in the ascendant, and a spermatozoon is one in which catabolism reigns. It is easy to see how the fertilization of the *ovum* leads to its segmentation, on this view. But theories of this nature are only partially explanatory. No theory can be true or even of temporary value, unless it harmonizes with the majority of known facts, and when no one fact is fatal to it.

We have yet to enquire how a division of this sort is determined in exactly the mode needful for the good of the species. Not only do we enquire how are cells divided so as to be different, and what causes this difference, but the great question is how is the response of protoplasm to the action of the environment such as to intelligently adapt the being to the conditions of the environment. When an amœba ascertains from